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Section II. REMARKS

The pending claims under consideration in the application are claims 1-12, 14, 16-39, 41-46, 49-63, 65, 67-90, 92-97, 100-106, and 109-126.

Allowable Subject Matter

In the July 26, 2005 Office Action, claims 9-51,^{1,2} 60-67,³ 103-106 and 109-115 were allowed. Applicants acknowledge such indication of allowance.

In addition, claims 2, 53, 68-71 and 76-102⁴ were indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicants acknowledge such indication of contingent allowability of claims 2, 53, 68-71 and 76-102, and respectfully request reconsideration of all pending claims 1-12, 14, 16-39, 41-46, 49-63, 65, 67-90, 92-97, 100-106, and 109-126.

Objection to Claim 100

In the July 26, 2005 Office Action, claim 100 was objected to because it depended from cancelled claim 99.

Claim 100 has been amended to depend from claim 96, thereby obviating this objection.

Amendment to Claim 1 and New Claims 116-126

Applicants have amended claim 1 herein to recite:

¹ Claims 13 and 15 had been previously cancelled. Applicants acknowledge the allowability of claims 9-12, 14, and 16.

² It is noted that pending claims 17-47 and 49-51 directly or indirectly depend from claim 1. Accordingly, applicants acknowledge the contingent allowability of said claims.

³ Claims 64 and 66 had been previously cancelled. Applicants acknowledge the allowability of claims 60-63, 65 and 67.

⁴ Claim 99 had been previously cancelled. Applicants acknowledge the contingent allowability of claims 76-98 and 100-102.

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“A deposition composition for depositing material on a substrate, said deposition composition comprising a supercritical fluid and a precursor of the material to be deposited on the substrate, wherein said precursor includes a metal atom, and wherein said material to be deposited comprises a material selected from the group consisting of high-k material, copper diffusion barrier material, nitride material, metal nitride material, barrier layer material, oxynitride barrier layer material, nitride barrier layer material, silicide barrier layer material, and copper seed layer material, with the proviso that when the material to be deposited comprises the copper seed layer material, the precursor comprises at least one copper precursor selected from the group consisting of copper (II) carboxylates, copper (I) cyclopentadienes, copper (I) phenyls, copper (I) amides, and Lewis base adducts of the aforementioned copper (I) species.” (emphasis showing added claim limitation(s))

Support for the high-k/ material can be found in original claim 17. Support for the copper diffusion barrier material can be found in original claim 27. Support for the nitride material can be found in original claim 23. Support for the metal nitride material can be found in original claim 26. Support for the barrier layer material can be found in original claims 34 and 35. Support for the oxynitride barrier layer material can be found in original claim 36. Support for the nitride barrier layer material can be found in original claim 37. Support for the silicide barrier layer material can be found in original claim 38. Support for the copper seed layer material can be found in original claim 40.

Support for new claim 116 can be found in original claim 41.

Support for new claims 117-120 can be found in the instant specification at paragraphs [0050] and [0051].

Support for new claims 122-126 can be found in the instant specification at paragraph [0002].

No new matter has been added herein.

Rejection of Claims on Reference Grounds, and Traversal Thereof

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In the July 26, 2005 Office Action:

claims 1, 3-6, 52 and 54-57 were rejected under 35 U.S.C. §102(b) as being anticipated by Sievers et al. (U.S. Patent No. 4,970,093);

claim 107 was rejected under 35 U.S.C. §102(e) as being anticipated by Pessey et al. (U.S. Patent No. 6,592,938);

claim 108 was rejected under 35 U.S.C. §102(b) as being anticipated by Wakayama et al. (U.S. Patent No. 6,194,650); and

claims 7-8, 58-59 and 72-75 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sievers et al. in view of Marsh (U.S. Patent No. 6,284,655).

These rejections are traversed in application to the claims as amended herein. The patentable distinction of the amended claims over the cited references is set out in the ensuing discussion.

Rejections under 35 U.S.C. §102

1. In the July 26, 2005 Office Action, claims 1, 3-6, 52 and 54-57 were rejected under 35 U.S.C. §102(b) as being anticipated by Sievers et al. (U.S. Patent No. 4,970,093) (hereinafter Sievers). Applicants traverse such rejection.

Sievers relates to the methods of chemically depositing a film of a desired material on a substrate using a supercritical fluid solution. Deposited materials disclosed include ceramic metal oxides, metal carbonates, oxide and/or hydroxide containing films, Y-Ba-Cu-O superconducting films, thin films of copper and thin films of tungsten.

As introduced hereinabove, applicants have amended claim 1 herein to recite:

"A deposition composition for depositing material on a substrate, said deposition composition comprising a supercritical fluid and a precursor of the material to be deposited on the substrate, wherein said precursor includes a metal atom, and wherein said material to be deposited

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comprises a material selected from the group consisting of high-k material, copper diffusion barrier material, nitride material, metal nitride material, barrier layer material, oxynitride barrier layer material, nitride barrier layer material, silicide barrier layer material, and copper seed layer material, with the proviso that when the material to be deposited comprises the copper seed layer material, the precursor comprises at least one copper precursor selected from the group consisting of copper (II) carboxylates, copper (I) cyclopentadienes, copper (I) phenyls, copper (I) amides, and Lewis base adducts of the aforementioned copper (I) species." (emphasis showing added claim limitation(s))

Comparing Sievers with applicants' claimed invention, it can be seen that Sievers does not teach or suggest the deposition of applicants' enumerated materials.⁵ With regards to the deposition of copper films, Sievers does not teach or suggest applicants' enumerated copper precursor species.

It is well established, as a matter of law, that a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987).

It is apparent from the foregoing that Sievers does not expressly or inherently anticipate applicants' claimed invention because Sievers does not in any way teach or disclose a composition formulated to deposit applicants' enumerated materials.

Applicants therefore respectfully request withdrawal of the §102(b) rejection of claims 1, 3-6, 52 and 54-57 based on Sievers.

Applicants' new claim 116 is also patentable over Sievers. New claim 116 recites:

"A deposition composition for depositing material on a substrate, said deposition composition comprising a supercritical fluid and a precursor of the material to be deposited on the substrate, wherein said precursor

⁵ It is noted that the Examiner admitted that Sievers does not "disclose . . . a barrier layer precursor for forming a metal nitride or a metal oxynitride barrier . . ." (see July 26, 2005 Office Action, page 4, point 7, lines 4-5).

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comprises a metal complex including at least one ligand selected from the group consisting of carboxylates, cyclopentadiene, phenyls, and amides.”

The only metal complex species recited in Sievers are metal β -diketonates. Accordingly, Sievers does not anticipate applicants' claim 116 which recites metal complexes having carboxylate, cyclopentadiene, phenyl or amide ligands.

2. In the July 26, 2004 Office Action, claim 107 was rejected under 35 U.S.C. §102(e) as being anticipated by Pessey et al. (U.S. Patent No. 6,592,938) (hereinafter Pessey). Applicants traverse such rejection.

Claim 107 has been cancelled herein, thereby obviating this rejection.

It is noted that claims 43 and 94 have been converted to independent claims and relate to compositions including copper precursor compounds. Claim 43 recites, *inter alia*:

“A deposition composition for depositing material on a substrate, said deposition composition comprising a supercritical fluid and a precursor of the material to be deposited on the substrate, wherein the precursor comprises at least one copper precursor selected from the group consisting of

- (1) Cu(pentafluorophenyl) pentamer
- (2) Cu(thd)₂
- (3) Cu(dmhd)₂
- (4) Cu(bzac)₂
- (5) Cu(CHB)₂
- (6) Cu(oxalate)
- (7) Cu(formate)₂
- (8) Cu(acetate)₂
- (9) (VTMS)Cu(hfac)
- (10) Cu(tod)₂
- (11) CpCuPMe₃
- (12) Cu(dibm)₂

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- (13) (CO)CuCl
- (14) (VCH)Cu(hfac)
- (15) Cu(tfhzm)₂
- (16) (MHY)Cu(hfac)
- (17) (COD)Cu(hfac)
- (18) (DMCOD)Cu(hfac)”

Comparing applicants' claims 43 and 94 with the Pessey teaching, it can be seen that applicants' claims do not include a recitation of copper acetylacetonate or copper hexafluoroacetylacetonate, which are the only two organometallic compounds enumerated in Pessey (see, e.g., col. 3, lines 61-62) and as such, applicants' claims 43 and 94 are not anticipated by Pessey.

In addition, applicants' new claim 116 is also patentable over Pessey. The only metal complex species recited in Pessey are copper acetylacetonate or copper hexafluoroacetylacetonate. Accordingly, Pessey does not anticipate applicants' claim 116 which recites metal complexes having carboxylate, cyclopentadiene, phenyl or amide ligands.

Applicants therefore respectfully request withdrawal of the §102(e) rejection of claim 107 based on Pessey.

3. In the July 26, 2004 Office Action, claim 108 was rejected under 35 U.S.C. §102(b) as being anticipated by Wakayama et al. (U.S. Patent No. 6,194,650) (hereinafter Wakayama). Applicants traverse such rejection.

Claim 108 has been cancelled herein, thereby obviating this rejection.

It is noted that claims 45 and 96 have been converted to independent claims and relate to compositions for depositing a noble metal and/or a noble metal oxide on a substrate, wherein said precursor comprises a metal precursor selected from the group consisting of metal carbonyls, metal (β -diketonate)_x•L wherein x = 1, 2 or 3 and L = Lewis base ligand, and mixed ligand compounds.

Wakayama relates to a supercritical coating process and recites that the noble metal reaction

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precursor may consist of:

“an alkoxide of a noble metal, an acetylacacetate of a noble metal, an organic salt of a noble metal, a nitrate of a noble metal, an oxychloride of a noble metal, and a chloride of a noble metal . . . or a combination of two of more of these.” (see Wakayama, col. 13, lines 52-57)

Comparing Wakayama with applicants' claims 45 and 96, it can be seen that Wakayama does not teach or suggest applicants' claimed noble metal precursor compounds, specifically metal carbonyls, metal (β -diketonate)_x•L, and mixed ligand compounds and as such, applicants' claims 45 and 96 are not anticipated by Wakayama.

In addition, applicants' new claim 116 is also patentable over Wakayama. Wakayama does not teach or suggest applicants' claimed ligands, specifically carboxylate, cyclopentadiene, phenyl or amide ligands.

Applicants therefore respectfully request withdrawal of the §102(b) rejection of claim 108 based on Wakayama.

Rejection under 35 U.S.C. §103

In the July 26, 2005 Office Action, claims 7-8, 58-59 and 72-75 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sievers et al. in view of Marsh (U.S. Patent No. 6,284,655). Applicants traverse such rejection.

As introduced hereinabove, Sievers relates to the methods of chemically depositing a film of a desired material on a substrate using a supercritical fluid solution. Deposited materials disclosed include ceramic metal oxides, metal carbonates, oxide and/or hydroxide containing films, Y-Ba-Cu-O superconducting films, thin films of copper and thin films of tungsten.

Marsh relates to the chemical vapor deposition of a substantially carbon- and oxygen-free conductive layer, including a conductive barrier layer (see Marsh, col. 11, lines 10-19).

It is initially noted that Marsh is devoid of any teaching relating to the use of a supercritical fluid

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solution for the deposition of precursors onto a substrate, and instead teaches chemical vapor deposition. It is well established in the deposition arts, that supercritical fluid deposition is not the same process as chemical vapor deposition, requiring different deposition apparatuses and different deposition conditions.

As indicated by the Examiner, Marsh teaches the deposition of a conductive barrier layer at column 11, lines 10-19. Considering this teaching of Marsh as a whole, as the Examiner must do,⁶ it can be seen that Marsh expressly teaches that the conductive barrier layer should be substantially carbon-⁷ and oxygen-free⁸ (see Marsh, col. 3, lines 56-58).

The Examiner is respectfully reminded that "teachings of references can be combined *only* if there is some suggestion or incentive to do so." *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988) (quoting *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984)) (emphasis in original). The examiner can satisfy the burden of showing obviousness of the combination "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references" *In re Fritch*, 23 U.S.P.Q.2d 1780, 1783(Fed. Cir. 1992) (emphasis added).

Comparing the Marsh teaching with Sievers, it can be seen that they are converse teachings. The Examiner contends that the teaching of Marsh relating to conductive barrier layers, which must be substantially carbon- and oxygen-free, can be imported into Sievers, which expressly teaches the formation of oxygen- and carbon-containing species, including ceramic metal oxides, metal carbonates, oxide and/or hydroxide containing films, and Y-Ba-Cu-O superconducting films, all of which have substantial amounts of oxygen. Clearly, this is not objectively obvious combination.

In the present case, there can be no motivation or suggestion to combine Sievers and Marsh because (i) they teach completely unrelated deposition methods and (ii) Marsh expressly recites that the conductive barrier material must be substantially carbon- and oxygen-free while Sievers

⁶ *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303 (Fed. Cir. 1993), *cert. denied*, 469 U.S. 851 (1984).

⁷ defined to be preferably about 1.0% by atomic percent or less (see Marsh, col. 3, lines 1-5).

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expressly teaches the deposition of oxygen-containing species. In fact, it can be argued that Marsh's teaching relating to the deposition of conductive barrier layers teaches away from Sievers.⁹

It is noted that the Examiner indicated that Marsh discloses the deposition of an oxynitride layer, which is specifically disclosed in Marsh as an insulative layer with no indication as to what the insulative metal species should be (see Marsh, col. 12, lines 16-22 and col. 12, line 66 through col. 13, line 9). Accordingly, the Examiner failed to provide objective evidence that applicants' claimed oxynitride material is obvious over Sievers in view of Marsh.

In addition, it is noted that the Examiner contended that Marsh "discloses the supercritical fluid comprises ammonia and a precursor for forming a nitride material on the substrate at a temperature below 200°C" [col. 2, line 53-col. 3, line 54]" (see July 26, 2005 Office Action, page 4, point 7, lines 16-18). Firstly, as discussed hereinabove, Marsh does not disclose, nor suggest, a supercritical fluid. Secondly, applicants have been unable to locate the disclosure in Marsh relating to the deposition of a nitride material using ammonia at a temperature below 200°C.

Respectfully, the Examiner is not considering the Marsh teaching as a whole and has taken the teaching out of context. This compels the conclusion that the rejection is based solely on hindsight, which is legally impermissible.

In conclusion, contrary to the Examiner's contention, there is no motivation or suggestion to combine Sievers and Marsh. Accordingly, the Examiner has not established a *prima facie* case of obviousness of applicants' claims 7-8, 58-59 and 72-75 based on Sievers in view of Marsh. Withdrawal of the §103 rejection is respectfully requested.

Fees Payable

Four (4) dependent claims have been converted into independent claims, six (6) claims have been cancelled, two (2) of which are independent, and eleven (11) claims, one (1) of which is

⁸ defined to be preferably about 1.0% by atomic percent or less (see Marsh, col. 3, lines 5-9).

⁹ it is improper to combine references where the references teach away from their combination. See, e.g., *In re Grasselli*, 218 U.S.P.Q. 769, 779 (Fed. Cir. 1983).

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independent, have been added herein. Thus, an added claims fee of $(4 \times \$200.00) + [(1 \times \$200.00) + (11 \times \$50.00)] - [(2 \times \$200.00) + (6 \times \$50.00)] = \850.00 is due.

The total fee of \$850.00 is authorized to be charged in the attached Credit Card Authorization Form. Authorization is also hereby given to charge any deficiency in applicable fees for this response to Deposit Account No. 08-3284 of Intellectual Property/Technology Law.

CONCLUSION

Based on all of the foregoing, pending claims 1-12, 14, 16-39, 41-46, 49-63, 65, 67-90, 92-97, 100-106, and 109-126 are now in form and condition for allowance. If any issues remain, incident to the formal allowance of the application, the Examiner is requested to contact the undersigned attorney at (919) 419-9350 to resolve same, so that the patent on this application can be issued at the earliest possible time. The Examiner's thorough review of the application is acknowledged with appreciation.

Respectfully submitted,



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